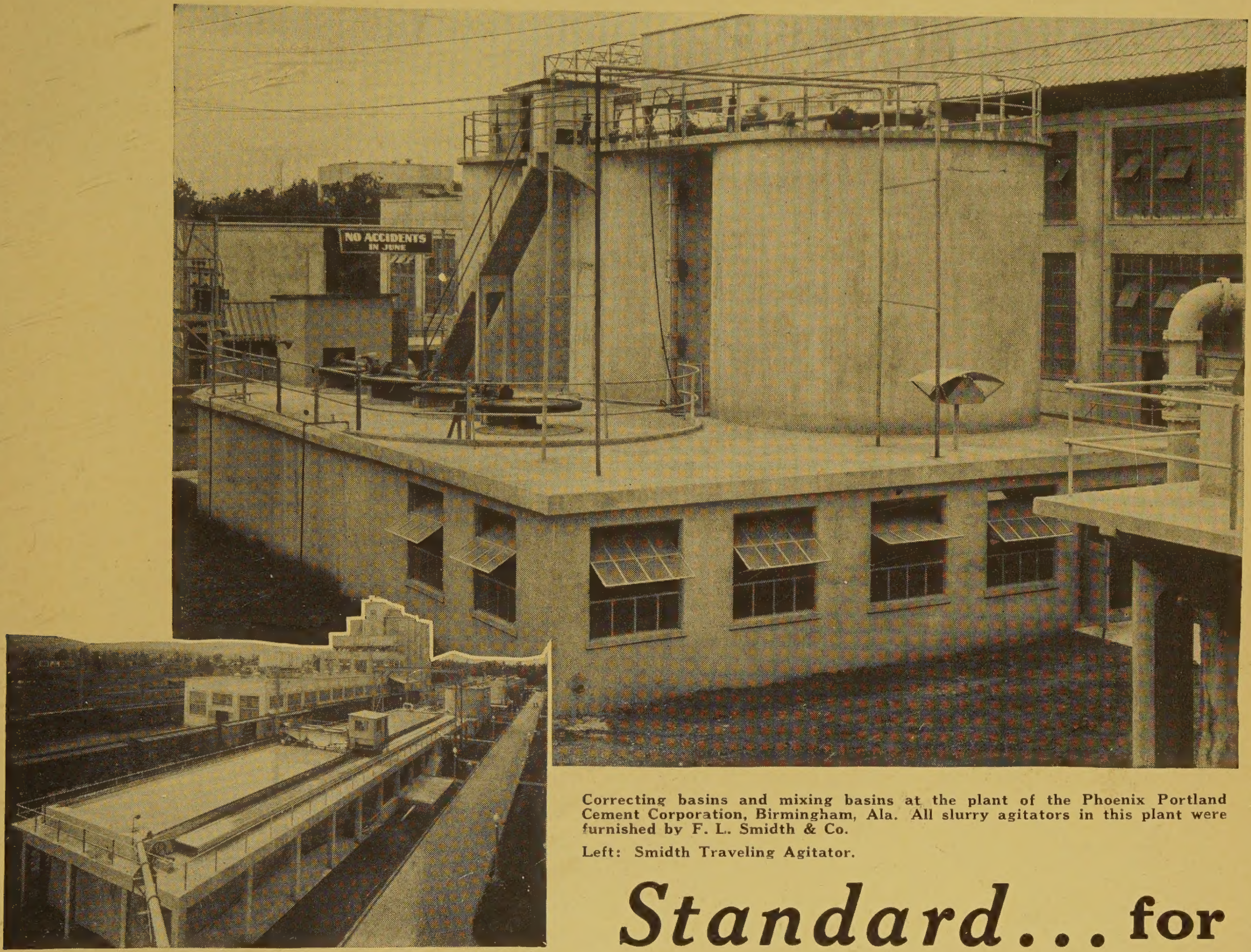
MILL SECTION of

Concrete



Correcting basins and mixing basins at the plant of the Phoenix Portland Cement Corporation, Birmingham, Ala. All slurry agitators in this plant were furnished by F. L. Smidth & Co.

Left: Smidth Traveling Agitator.

Standard... for the Agitation of Cement Slurry

THE standard agitators furnished by F. L. Smidth & Co., Inc., New York, for the several basins at the Phoenix plant, combine mechanical agitation with air. On each of the stirring arms is mounted on air nozzle throughwhich is supplied a quantity of air just sufficient to make the vertical mix. The stirring arms mechanically make the horizontal mix.

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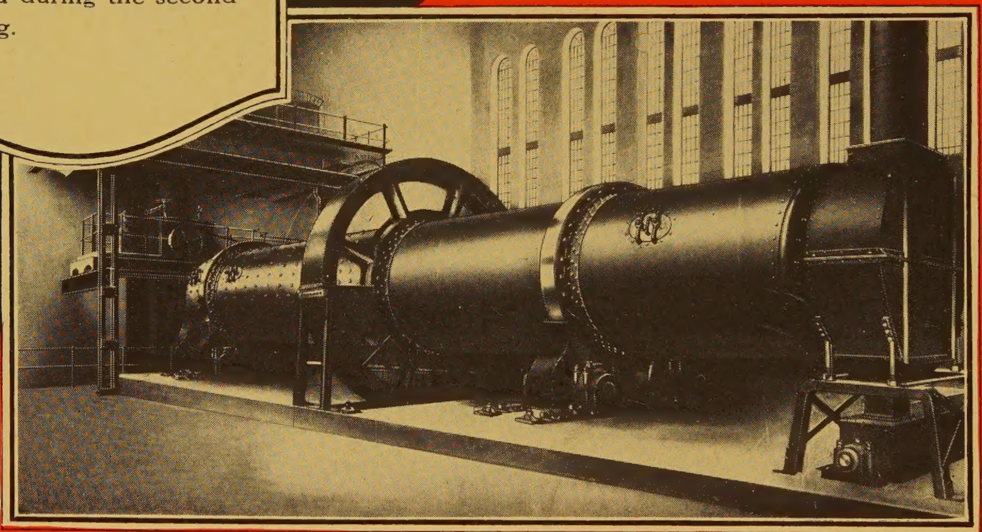

POLYSIUS CORPORATION
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MILL SECTION of

Concrete

The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

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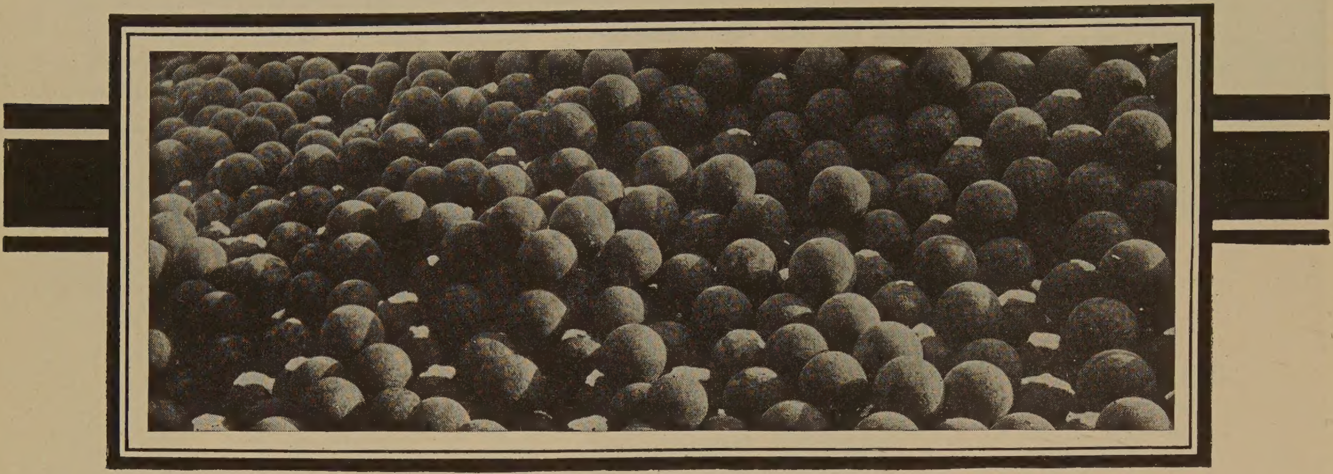

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MILL SECTION of

Concrete

Vol. 32 Chicago, February, 1928 No. 2

High Early Strength Portland Cements in Europe

A Discussion of the Development of Special High Early Strength Portland Cements in Europe—Their Early History—The Reasons for Their Introduction—Their Chemical Composition—Factors Influencing Quality of Cement—Physical Characteristics

By E. C. BLANC

The section on super-portland cements in our book on modern cements recently published in Paris under the title "Le Ciment Portland," was written entirely by M. Blanc, with the advice of M. Hendrickx.

Since that book is not likely to have any serious American sale, I am translating here the section dealing with these high early strength portland cements, because the subject is rapidly becoming of general interest in America.

This article will be followed with translations of certain other sections on related subjects. There is the more reason for taking this step, in that the 3rd edition of my "Cements, Limes and Plasters" will not repeat the matter now presented, its chapters on alumina cements and super-portlands being prepared de novo, from the mass of other data and experience now available.

I might preface the section by saying that we are here using the term super-portland in its original sense. It must not be confused with the Super Cement now being made and sold in this country. As I define it in my own text, now in preparation, it denotes a cement of the portland type which is given extremely rapid hardening and high early strength through care in manufacture, and without any addition of extraneous material during or after its burning, grinding or sacking.—Edwin C. Eckel.

THE first super-portland cements appear to have been made in Austria, around 1912-1913, at the Vorarlberg mill, under the direction of M. Spindel. Almost immediately afterward the Swiss Holderbank mill, under the technical direction of M. Gigy, put on the market, under the name of "Marque Speciale Holderbank," a cement whose remarkable qualities were utilized especially for military needs during the World War. In 1916 the Soc. des Ciments Francaises attained results of the same order.

In 1919, taking up experimental work of pre-war days, the Saxon-Bohemian Portland Cement Co. began making, at its mill at Tschischkowitz, in the new republic of Czechoslovakia, a similar super-portland. This work was carried out under the direction of Dr. Haensel, and the brand was marketed under the name "Standart."

In France, the extraordinary results attained by the use of alumina cements which were free to be pushed for commercial purposes in 1919-1922 only after the war demands had subsided, incited the portland cement manufacturers to seek, in the improvement of their products, a means of competing with the very serious competition of alumina cements. The principal French companies thus came to place on the market successively each its own brand of super-portland cement. Such were the "Ciment Francais high-strength," the "Super Flambeau" of the Societe Coloniale, the "Super Ciment France" of the Etab. Poliet et Chausson, the "Super-Crown" of the Soc. Cem. de Dannes, the "Super Vicat" of the world-known Vicat company, and the "Ceberit" of the Mons mill of Ciments et Briquetteries Reunis.

In Germany production of the super-portlands followed a parallel though later development, and there is no room for doubt as to their future importance as a branch or stage in the portland cement industry.

Manufacturing Methods

As it is easy to see from examination of the analyses given in Table XXX which follows, the chemical composition of the super-portlands does not differ, on the average, from that of the ordinary portlands. (On this point I must express dissent; the matter will be discussed in detail elsewhere. *E. C. E.*) It results also from other observations that the new effects are not produced, as in the case of special steels, by the presence of slight traces of rarer components. The manufacture of super-portlands is carried out by the same processes as are used in making the ordinary cements, the special quality being due to the special care taken at certain phases of the process.

M. Hendrickx has summarized the three factors which are available to the manufacturer for this increase in the technical value of his product: These are:

(1) Realization of the most favorable physical and chemical composition of the raw mixture.
(2) Operating the furnaces with a view to obtaining optimum conditions as to burning and cooling.
(3) Increase in the percentage of impalpable elements in the final ground cement.

Under favorable conditions (as to composition) one alone of these factors may suffice to secure a super-portland of high value. Under unfavorable conditions all three may have to be pressed into service.

The mixture must be studied from the viewpoint of its chemical composition, seeking the best constitution formula, and from the viewpoint of its physical-chemical condition, seeking the most complete and thorough mixture with facilities for complete burning. (The formula chiefly used in France for mixing is that of Hendrickx; $CaCO_3 = 4.16\ SiO_2 + 2.6\ R_2O_3$.)

The burning should be conducted with a view to obtaining the largest crystals. According to M. Hendrickx only crystals actually broken during the grinding can supply active elements. With equal finenesses of grinding, one therefore obtains better results as the proportion of large crystals is increased.

Table XXX. Chemical Analyses of Various Super-Portlands

	(1)	(2)	(3)	(4)	(5)	(6)
Silica	22.10	19.53	21.2	20.10	16.96	20.79
Alumina	6.70	7.38	5.03	3.61	8.17	5.21
Iron oxide	2.75	2.20	4.33	5.90	6.05	2.40
Lime	62.00	61.40	63.60	64.60	64.58	65.23
Magnesia	1.62	1.95	2.11	2.68	1.61	0.11
SO_3	0.59	2.57	0.84	2.70	1.52	0.87
Ign. loss	3.65	4.18	2.0	0.40	0.44	3.85
$\frac{SiO_2}{R_2O_3}$	2.34	2.04	2.28	2.12	1.19	2.73
$\frac{CaO}{SiO_2+R_2O_3}$	1.97	2.11	2.08	2.18	2.07	2.30

Effect of Fine Grinding

Extreme fineness of grinding is not an invariable characteristic of the super-portlands. Certain cements of very high quality are only ground to a medium fineness—12 to 15 per cent residue on a 4900 mesh sieve—while certain others, even when ground to extreme fineness, do not necessarily yield super-portlands. In general, however, the fineness of the super-portlands is notably greater than that of ordinary cements. Exaggerated fineness, on the other hand, seems to lead to cements which, in some cases, do not store well.

As an extreme example of fineness we have the super-cement Barenstark, which leaves only 1.6 per cent residue on the 4900 mesh sieve, and only 5.6 per cent on the 10,000 mesh. This is secured by passing the cement twice and sometimes thrice through the tube mills.

Physical Characteristics

Table XXXI. Physical Characteristics of Super-Portlands

Brand	(A)	(B)	(C)	(D)	(E)	(F)
Set begins	2h,35m	2h,30m	3h,30m	1h,55m	2h	3h
Set ends	4h,15m	5h,15m	7h,0 m	4h,40m	5h	7h
Residue, 900	0.1%	none	0.2%	0.2%	none	0.4%
Residue, 4900	0.9%	5.0%	6.0%	9.5%	1.6%	4.4%
Tensile, 1;3 plastic mortar, kg. per sq. cm.						
1 day	12.1	22.	——	——	——	——
2 days	22.4	28.	——	——	——	——
3 days	31.4	32.	28.8	——	27.0	27.0
7 days	35.7	38.	32.3	32.5	25.7	29.8
28 days	36.6	42.	39.0	40.0	32.9	37.5
Compression, 1:3 plastic mortar, kg. per sq. cm.						
1 day	65.	180.	——	——	——	——
2 days	156.	280.	——	——	——	——
3 days	200.	330.	312	348	243	320
7 days	294.	450.	423	426	338	424
28 days	361.	530.	545	570	428	538

The chief physical characteristics of the super-portlands are summarized in Table XXXI following. On the average, these cements show at 3 days—and even in certain cases at 2 days—strengths superior to those demanded of ordinary portlands in 28 days by most specifications. Other properties—setting time, volume constancy, chemical composition, specific gravity—do not differ notably from the usual portland cement.

The super-portlands exhibit the same qualities as ordinary portlands as regards the various physical and chemical factors which influence their set strength and resistance to decomposition—except that certain of the super-portlands seem to set better at low temperatures. On the other hand, the super-portlands seem to lose strength more rapidly on storage, and special precautions must be taken in that regard.

The super-portlands can be made at any portland cement mill which has available proper raw materials, and without any serious increase of cost. Their sales price is therefore not very much greater than ordinary cements, a fact which permits the super-portlands to compete with success against the alumina cements, especially in countries where the manufacture of these latter is made difficult by the absence of any bauxite deposits.

(To be continued)

Accidents in Quarry Industry in 1926

A slight increase in the death rate from accidents and a small reduction in the injury rate occurred in the stone quarrying industry in 1926 as compared with 1925, according to reports received from operating companies by the United States Bureau of Mines, Department of Commerce. The death rate, based upon a standard of 300 days of exposure to risk, was 1.87 per thousand employees as compared with 1.78 in the preceding year. The injury rate was 160 per thousand employees as against 170 in 1926.

For purposes of the bureau's study of accidents at quarries, the reports were classified into seven main groups, according to kind of stone produced, as follows: limestone, marble, slate, granite, sandstone, cement-rock, and trap-rock. Reduced fatality rates were reported for quarries producing cement-rock, sandstone, slate, and trap-rock and lower injury rates were reported for quarries that produced cement-rock, granite, sandstone, and trap-rock.

The quarry industry as a whole employed 91,146 men who worked 24,708,400 shifts, both of these figures being slightly smaller but substantially the same as in 1925.

International Standards for Cement*

An Analysis of the Cement Specifications of Various Nations, Pointing Out the Advantages and Disadvantages of International Standardization of Cement Specifications

By Dr. C. R. PLATZMANN

THE importance of the introduction of cement standards was greatly emphasized at the fiftieth anniversary celebration of the Association of German Portland Cement Manufacturers. It was repeatedly stated that Germany was first to publish standards in 1878 and that these had greatly influenced the standards of other countries.

In view of the fact that fifty years have passed since these standards were published, it seems pertinent to review the present state of cement standards and also to point out the reason why international standardization of specifications has not been successful thus far. It is obvious that not only the cement manufacturer would benefit by such standardization, but also the consumer and especially the cement dealer.

Standards Tabulated

In tabulating the standards of 25 different countries, a similar tabulation by A. C. Davis ("A Hundred Years of Portland Cement, 1824 to 1924," London, 1924, p. 191) was used together with that published by "Zement-Verlag" and the original specifications of the different countries. The author has made an effort to make the table as clear as possible and to arrange the items in a way facilitating comparison and giving an idea of possible standardization. Also all values are reduced to their metric equivalents.

Table I contains a list of the different countries, the year in which their specifications were published, the body which worked out the specifications and the governmental office by which they were approved. The alphabetical arrangement of the countries is followed throughout the table below.

Table II contains data on fineness, specific gravity and chemical composition. The 4900-mesh and 900-mesh sieves (per sq. cm.) are used extensively, though the allowable percentage retained on these sieves varies greatly and follows no apparent rule. An equal number of meshes per square centimeter does not always indicate the same diameter of wire. The definition of a certain mesh is still somewhat vague. In this connection the clear size of opening is much more indicative than the number of meshes per unit of surface. The German method is to specify the size of opening instead of the diameter of wire. This appears rational and has also been adopted in the United States, Esthonia, Norway and Sweden. The percentages retained on the 900-mesh sieve vary from 1 per cent (England and Jamaica) to 10 per cent (Spain). Nineteen out of 25 countries specify the percentage to be retained on the 900-mesh sieve, while 16 have accepted a specification of the quantity to be retained on the 4900-mesh sieve. Among the former, the average value is 4 per cent, while among the latter the average is 22 per cent.

Chemical Composition

Of the 25 countries only nine have kept a requirement of specific gravity and specified its value in their specifications. Uniformity of specifications may easily be achieved in this connection by agreeing to drop the determination of specific gravity from the standards. This was done in the 1926 specifications of the United States.

With reference to chemical composition, almost all countries have specified the magnesia and sulfuric anhydride content. The former varies from 5 to 2 per cent, the latter from 3 to 1.5 per cent. Recent investigations of magnesia cements carried out by the eminent American scientist, P. H. Bates of the U. S. Bureau of Standards, established that even 9 per cent magnesia is not always detrimental to cement and that 6.5 per cent could be used without any hesitation. Thus the limiting of the magnesia content to 3 per cent, as is done in Italy, Japan, Belgium, Russia and Chile, appears to be but an undue complication of the manufacturing process and rules out materials which could be used successfully in cement manufacture. It also means that countries which are more lenient in this respect are prevented from exporting their cement to the above listed countries, as their cement would not conform to local specifications even though it were 100 times better than the domestic product. Still less acceptable is the Italian specification of a maximum SO_3 content of 1.5 per cent. Chile specifies the same percentage. The German specification, which limits the sulfuric anhydride content to 2.5 per cent seems to be the most practical. This is undoubtedly the reason why many other countries producing high grade cements have considered the specification of 2.5 per cent as sufficient. The specification of 2 per cent by the United States, Australia, Argentine, Brazil, Canada and Japan seems irrational, as certain grades of coal make it impossible to produce cement with less than 2 per cent SO_3, particularly when the gypsum admixtures are considered. Loss on ignition, insoluble residue and foreign admixtures determinations are still specified by a number of countries, but are no longer required in the majority of cases. An international agreement on cement standards could easily do away with specifications of loss on ignition and insoluble residue. To guard against an excessive loss on ignition, it should then be required that a cement stored for over half a year be tested again to determine its standard properties.

Time of Set

Table III gives data of tests of time of set. The Vicat needle is used exclusively, the United States being the only country where a parallel test with a Gillmore needle is required. The weight and height of the specimens are generally uniform, but the method of determining initial set differs greatly. While most countries specify that the initial set be defined as the moment in which the needle no longer penetrates the truncated cone below, other coun-

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*Translated from *Zement*, November 10, 1927, by Margaret Arronet Corbin, Chicago Heights, Ill.

TABLE I

Ref. No.	Country	Published by and approved by	Year
1.	Belgium	Railway, Post and Telegraph Ministry	1912
2.	Denmark	Technical Society	1911
3.	Germany	Association of German Portland Cement Manufacturers, State Dept. of Transportation	1927
4.	England	British Engineering Standards Assn.	1925
5.	Esthonia	Approved by Esthonian Govt. March 30	1926
6.	France	Permanent Standards Commission	1919
7.	Holland	Reinforced Concrete Specifications	1918
8.	Italy	Italian Society for the Study of Building Materials	1925
9.	Jugoslavia		1922
10.	Norway	Department of Labor	1917
11.	Austria	Austrian Assn. of Engineers and Architects	1925
12.	Russia	III. All-Union Convention of Structural Materials Industry, Jan. 25-31, 1925, Moscow	1925
13.	Sweden	Society of Swedish Engineers and Architects	1924
14.	Switzerland	Society of Swiss Engrs. and Archts.	1919
15.	Spain		1915
16.	Czechoslovakia	Dept. of Labor, Feb. 16, 1925	1925
17.	Argentina	Dept. of Public Works	1914
18.	Australia	Commonwealth Eng. Standards Assn.	1926
19.	Brazil	Spec. of Brazil State Railways	
20.	Chile		
21.	Jamaica	Govt. Bulletin No. 269, May 17, 1926; Governor's decree, Oct. 18, 1926	1926
22.	Japan		1927
23.	Canada	Canadian Engineering Standards Assn.	1922
24.	Queensland	Standard Specifications for Railways (Brisbane test)	
25.	U. S. of America	American Society for Testing Materials, Philadelphia, Pa.	1926

TABLE II

Ref. No.	Country	Fineness: Per cent Retained	Fineness: Mesh per sq. cm.	Fineness: Diameter of wire mm.	Specific Gravity minimum	Chemical Composition: MgO per cent	Chemical Composition: SO$_3$ per cent	Chemical Composition: Insoluble Residue per cent	Chemical Composition: Loss on Ignition per cent	Chemical Composition: Adm. per cent
1.	Belgium	5	900	0.099	3.07	3.0	2.5	1.5	3.0	—
2.	Denmark	3	900	0.099	—	—	—	—	—	3.0
3.	Germany	5	900	mesh opening 0.222	—	5.0	2.5	—	—	3.0
4.	England	10 1	4900* 900*	0.046 0.112	—	4.0	2.75	1.5	3.0	—
5.	Esthonia	30 5	4900 900	mesh opening 0.215–0.240	—	5.0	2.5	—	—	3.0
6.	France	1	314	0.198	—	—	3.0	—	—	—
7.	Holland	25 3	4900 900	0.05 0.10	—	5.0	2.5	—	2.2	3.0
8.	Italy	20 2	4900 900	0.0508 0.099	3.00	3.0	1.5	—	—	3.0
9.	Jugoslavia	—	—	—	—	5.0	—	—	—	—
10.	Norway	30 4	4900 900	mesh opening 0.089 0.229	3.05	4.0	2.5	1.5	4.0	—
11.	Austria	25 3	4900 900	0.05 0.10	—	5.0	2.5	—	—	3.0
12.	Russia	30 5	4900 900	—	—	3.0	2.5	—	4.0	3.0
13.	Sweden	5	900	mesh opening 0.222	—	5.0	2.5	—	—	3.0
14.	Switzerland	25 2	4900 900	0.0508 0.099	3.10	—	—	—	2.0	2.0
15.	Spain	25 10	4900 900	—	3.05	5.0	3.0	—	—	—
16.	Czechoslovakia	25 4	4900 900	0.05 0.10	—	5.0	2.5	2.0	—	—
17.	Argentina	30 5	4900 900	0.05 0.15	3.05	4.0	2.0	—	—	3.0
18.	Australia	18	4900*	0.0457	—	4.0	2.0	1.5	3.0	—
19.	Brazil	2	900	—	3.1	3.0	2.0	1.0	3.0	—
20.	Chile	25 3	4900 900	— —	—	3.0 sea water 2.0	1.5	—	5.0	3.0
21.	Jamaica	10 1	4900 900	0.046 0.112	—	—	—	—	—	—
22.	Japan	17	4900	0.055	3.05	3.0	2.0	—	4.0	2.5
23.	Canada	22	6200	0.053	—	4.0	2.0	0.75	4.0	—
24.	Queensland	18 3	4900 900	0.05 0.11	3.0	—	—	—	—	—
25.	United States of America	22	6200	mesh opening 0.074	—	5.0	2.0	0.85	4.0	—

---

*Exactly 5022 and 895 meshes per sq. cm.

TABLE III

Ref. No.	Country	Setting Properties	Time of Set	Tests of Time of Set			
				Needle Thickness sq. mm.	Weight gm.	Height of Specimen mm.	Initial Set when needle:
1.	Belgium		Initial: min. 45m. Final: min. 4h. max. 12h.	1	300	40	No longer penetrates completely the specimen
2.	Denmark	Normal Quick	Initial: min. 1h. Final: min. 2h. max. 15h. As specified	1 round	300	40	Penetrates not more than 35 mm.
3.	Germany	Slow	Initial: min. 1h.	1 (abt.)	300	40	No longer completely penetrates
4.	England	Normal Quick	Initial: min. 30m. Final: max. 10h. Initial: min. 5m. Final: max. 30m.	1	300	40	No longer completely penetrates
5.	Esthonia	Slow	Initial: min. 1h.	1	300	40	Penetrates not more than 35 mm.
6.	France	Quick Medium Slow Very slow	Initial: min. 5m. 5–30m. 30m.–6h. min. 6h.	1 (abt.)	300	40	No longer completely penetrates the specimen
7.	Holland		Initial: min. 2h. (sea water 1h.) Final: min. 4h. (sea water 5h.)	1 (abt.)	300	40	No longer completely penetrates
8.	Italy	Slow	Min. 6h. Max. 12h.	1 (abt.)	300	40	As above
9.	Jugoslavia		3½–4h. min.	—	—	—	—
10.	Norway	Normal Quick	Initial: min. 1h. Final: max. 10h. As specified	1 (abt.)	300	40	No longer completely penetrates
11.	Austria	Quick Medium Slow	Initial: max. 10m. 10m.–1h. min. 1h.	1	300	—	As above
12.	Russia		Initial: min. 20m. Final: min. 1h. max. 12h.	—	—	—	—
13.	Sweden	Normal Quick	Initial: min. 1h. As specified	1 (abt.)	300	40	Stops 2 mm. above bottom of specimen
14.	Switzerland	Quick Slow	Final: max. 2h. Initial: min. 1h.	1	300	40	No longer completely penetrates
15.	Spain	Quick Slow	5–30m. Initial: min. 2h. Final: max. 12h.	—	—	—	—
16.	Czechoslovakia	Medium Slow	Initial: 30–60m. min. 1h. Final: max. 15h.	1	300	40	No longer penetrates completely
17.	Argentina		Initial: min. 35m. Final: min. 3h.	1	300	40	As above
18.	Australia	Slow	Initial: min. 1h. min. 3h. max. 12h.	1	—	40	Penetrates not deeper than 39 mm.
19.	Brazil		Initial: 1–3h. Final: 3–6h.	1	300	40	—
20.	Chile	Quick Slow	Initial: max. 10h. min. 1h.	—	—	—	—
21.	Jamaica		—	—	—	—	—
22.	Japan		Initial: min. 1h. Final: max. 10h.	1	300	40	—
23.	Canada		Initial: min. 30m. Final: max. 10h.	1ø	300	40	Penetrates not deeper than 35 mm.
24.	Queensland		Initial: 30m. Final: min. 2h. Max. 8h.	—	—	—	—
25.	United States of America		Initial: min. 45m.* Final: max. 10h.	1ø*	300*	40	Penetrates not deeper than 35 mm. in ½ min.

*Tested with Vicat needle; when tested with Gillmore needle initial set: min. 1h.; Gillmore needle ø 0.21 cm. weight used in determination of initial set 113.5 gm.

tries specify a penetration of 35 to 39 mm. Though these differences may be overcome in the future, the divergence among definitions of slow- and quick-setting cements is appalling. It might be argued that specifications of slow- and quick-setting cements are unnecessary. As quick-setting cements are used but little, their manufacture may be made subject to agreement of cement producers. A similar clause was introduced in the standards of Denmark and Sweden. A specification of initial set for normally setting cement of not less than 1 hour appears to be reasonable and to conform to practical requirements.

Table IV contains data of soundness tests and methods of making specimens for strength tests. The cold water soundness test, as specified by the German specifications, appears predominant. Second is the LeChatelier test, which has never been accepted in Germany, so that agreement on this point presents considerable difficulty. The boiling test, which is an accelerated soundness test, though at present occupying third place, has become increasingly popular in recent years.

Strength Tests

In making strength test specimens, the Bohme-Martens hammer apparatus and the ram vie with each other for first place. The method of making specimens by hand, as practiced in England, France, America and Jamaica should be eliminated, as it is subject to many accidental errors and assumes that all specimens are made by the same person, which at best is an insufficient guarantee of uniformity. In selecting between the hammer apparatus and the ram, the former is undoubtedly to be preferred, as the compacting of mortar produced by the former corresponds more nearly to practical conditions. The ram always yields higher strengths than those attainable in practice with the best tamping and mixing procedures. Only the use of the ram makes it possible for Austria to require a strength at 7 days of 220 kg. per sq. cm.

Table V reviews the strength specifications and shows that the new German specifications lead those of other countries. This table demonstrates that strength values can only be compared when due consideration is given to the

TABLE IV

Ref. No.	Country	Strength Test Specimens: Weight of Hammer kg.	Strength Test Specimens: Drop of Hammer cm.	Strength Test Specimens: Number of Blows	Is the quantitv of mixing water spec. for mortar?	Soundness Tests: Le Chatelier	Soundness Tests: Hot Water	Soundness Tests: Cold Water	Other Tests
1.	Belgium	[1]1.996 [2]3	[1]25.4 [2]50.799	[1]120 [2]150	No	+	+	—	—
2.	Denmark	Bohme-Martens Hammer Apparatus —	16.8	150	9%	Tentative		Decisive	
3.	Germany	Bohme-Martens Hammer Apparatus —	16.8	150	8–10%	—	—	+	—
4.	England	[3]Made by hand; trowel 212.62 kg.			No	+	—	—	—
5.	Esthonia	Bohme-Martens Hammer Apparatus —	16.8	150	8%	+	—	+	—
6.	France	—	—	—	Yes	+	—	—	—
7.	Holland	[2]3	[2]50	150	—	—	Sea water constrn. +	+	—
8.	Italy	[1]1.996 [2]3	[1]25.4 [2]50.799	[1]120 [2]150	—	+	—	—	Balls of neat cement boiled 3h.
9.	Jugoslavia	—	—	—	—	—	—	—	—
10.	Norway	Bohme-Martens Hammer Apparatus —	16.8	150	Yes	+	+	+	—
11.	Austria	[1]1.996 [2]3.2	[1]25.4 [2]50	[1]120 [2]150	No	—	+	+	Drying test 2/3h., 120°
12.	Russia	—	—	—	—	—	+	+	—
13.	Sweden	Bohme-Martens Hammer Apparatus 2	18	150	Yes	+	—	+	—
14.	Switzerland	[1]1.996 [2]3	[1]25.4 [2]50.799	[1]120 [2]160	No	—	+	+	—
15.	Spain	—	—	—	—	+	—	+	—
16.	Czechoslovakia	Bohme Hammer Apparatus 2	16.8	150	—	—	—	+	—
17.	Argentina	1.996	40.004	120	—	+	+	+	—
18.	Australia	Hammer Apparatus 2	—	150	Yes	+	80–94° +	+	—
19.	Brazil	—	—	—	—	+	+	—	—
20.	Chile	—	—	—	—	—	—	+	—
21.	Jamaica	[3]Made by hand; only trowel used in filling molds			—	+	—	—	—
22.	Japan	Bohme Hammer Apparatus 2	16.8	150	—	—	+	+	—
23.	Canada	Filling molds by hand; smoothing with trowel			Yes	—	+	—	—
24.	Queensland	"	"	"	—	+	—	—	—
25.	United States of America	Filling molds by hand; smoothing with trowel			Yes	—	+	—	—

[1] For tensile specimens. [2] For compression specimens. [3] No pressure.

properties of standard sand used.

While a number of countries specify a standard sand passing a 62- to 64-mesh sieve and retained on a 140-mesh sieve, Germany, Denmark, Esthonia, Italy, Norway, Austria, Sweden, Argentine and Czechoslovakia specify as criterion a certain size of opening through which the standard sand is to pass or on which it is to be retained. This specification conforms to the fineness specifications of these countries. The Spanish and Argentinian specifications requiring the determination of compressive strength on neat cement specimens are entirely misleading. The same is true of tension tests of neat cement specimens. Most specifications emphasize tensile tests at 7 days and compressive tests at 7 and 28 days. The variations are

TABLE V

Ref. No.	Country	Tensile Strength kg. per sq. cm. Neat		Tensile Strength 1:3		Size of cube cm.	Compressive Strength, kg. per sq. cm. Neat		Compressive Strength 1:3			Sand Used			
		7d.	28d.	7d.	28d.		7d.	28d.	7d.	28d.	Comb. Sur. 28d.	Passing sieve mesh	Retained on sq. cm.	Wire diameter mm.	
1.	Belgium	——	——	13	20	7	——	——	130	200	——	62 ——	—— 140	0.399 0.295	
2.	Denmark	——	——	12	16	7	——	——	120	200	——	Mesh opening 1.35 mm.	0.775 mm.		
3.	Germany	——	——	18	[1]30	7	——	——	180	275	350	Mesh opening 1.35 mm.	0.775 mm.	——	[1]28d. combined air and water curing
4.	England	42.18	——	22.85	25.03	——	——	——	——	——	——	62 ——	—— 140	0.417 0.274	
5.	Esthonia	——	——	14	——	7	——	——	140	200	250	Mesh opening 1.35 mm.	0.775 mm.	——	
6.	France	——	——	10	15	4	——	——	——	——	——	3 equal parts sand passing the following sieves 1.998 mm.	1.5 mm.	0.5 mm.	
7.	Holland	——	——	12	——	7	——	——	150	——	250	60	120	——	
8.	Italy	——	——	18	25	7	——	——	180	250	——	Mesh opening 1.49 mm.	0.998 mm.	——	
9.	Jugoslavia	——	——	12	22	——	——	——	——	222	——	——	——	——	
10.	Norway	——	——	14	20	7	——	——	140	200	——	Mesh opening 1.35 mm.	0.775 mm.	——	
11.	Austria	——	——	18	——	7	——	——	220	——	——	Mesh opening 1.35 mm.	0.775 mm.	——	
12.	Russia	25	35	10	14	——	——	——	140	——	——	——	——	——	
13.	Sweden	——	——	14	20	7	——	——	140	200	250	Mesh opening 1.35 mm.	0.775 mm.	——	
14.	Switzerland	——	——	——	22	7	——	——	——	260	——	62 ——	—— 140	0.399 0.299	
15.	Spain	[1]20 [2]12	[1]30	[1]7 [2]5	[1]15	——	[1]200 [2]72	[1]300	[1]70 [2]30	[1]150	——	——	——	——	[1]Slow-setting [2]Quick-setting
16.	Czechoslovakia	——	——	12	20	——	——	——	130	220	250	Mesh opening 1.35 mm.	0.775 mm.	——	
17.	Argentina	30	35	12	16	——	——	——	——	——	——	Mesh opening 1.49	0.998	——	
18.	Australia	——	——	17.57	22.84	7.6 or 7	——	——	——	200.3	250.98	62 ——	—— 140	0.417 0.274	
19.	Brazil	40	45	——	——	——	400	450	——	——	——	——	——	——	
20.	Chile	—— ——	—— ——	[1]10 [2]12	[1]15 [2]18	——	——	——	[1]120 [2]160 [3]120	[1]150 [2]180 [3]200	—— ——	——	——	——	[1]Quick-setting [2]Slow-setting [3]In sea water and reinforced concrete
21.	Jamaica	42.18	——	22.85	25.03	——	——	——	——	——	——	64 ——	—— 140	0.417 0.274	
22.	Japan	40	——	14	21	7	——	——	——	210	——	64 ——	—— 144	0.40 0.29	
23.	Canada	——	——	14.06	21.09	——	——	——	——	——	——	62 ——	—— 140	0.419 0.279	
24.	Queensland	31.6	38	14.1	16.9	——	——	——	——	——	——	62 ——	—— 140	0.417 0.274	
25.	U. S. of America	——	——	15.82	22.35	——	——	——	——	——	——	62 ——	—— 140	0.406 0.292	

still considerable, ranging from 5 to 22.85 kg. per sq. cm. for 7-day tensile strength and from 220 to 30 kg. per sq. cm. for 7-day compressive strength. Somewhat better agreement is shown by water cured compression specimens at 28 days. The combined air and water curing, advocated by Germany, has not thus far been generally accepted. It is of interest to note in this connection that even Australia follows Germany's example by adopting the practice of making specimens with the hammer apparatus in preference to England's methods. This might be said to prove that German practice of making specimens is the best and most reliable.

The tables demonstrate convincingly that standardization of specifications in the near future would be confronted with many difficulties and can be brought about only by stages. Most promising appears the standardization of fineness and time of set determinations.

Should the above aid international agreement if only by leading to the elimination of differences between two or three countries, the aim of the author will be achieved.

Making a Safety Convert of the New Man*

How the Riverside Portland Cement Company Sells the Safety Idea to a New Employe—Overcoming the New Man's Prejudices—Safety Helps

By A. S. BILDERBACK
Safety Engineer, Riverside Portland Cement Company

TIME and effort are required to make a safety convert of a new man. At the Riverside Portland Cement Company, this work is divided among several members of the organization. Two favorable reactions are obtained from the practice, namely,—the organization has the importance of safety constantly before it due to its active part, and the new man obtains the idea that the organization is interested in his welfare as well as safe production. The results of this tried plan have been good, but is subject to change should new conditions warrant it. Before discussing in detail the method of making a safety convert, our attention will be directed to the attitude of the new employee.

Attitude of New Employee

The average new employee usually has some well fixed safety ideas or opinions, which he has formed from experience and observation. These ideas can be divided into two groups, namely,—those which assist in interesting men in the value of safety and those which retard safety education.

Assisting Factors

1. The new man does not want to get hurt.
2. The new man wants his new job.
3. The new man wants to please the company and his boss, so that he can obtain a better job as soon as possible.

Retarding Factors

1. The new man believes accidents will always occur at intervals, because they have always occurred so in the past.
2. The new man fears his boss, not in a physical way, but because his boss can discharge him in his work.
3. The new man has an exaggerated opinion of his own ability to take care of himself. He prefers to mind his own business and let others do the same.
4. The new man views with suspicion all safety suggestions and company activities concerning his betterment.

It is not the writer's intention to explain why many men hold these ideas and opinions. We merely mention them as a factor that has to be considered when making a safety convert of a new man.

Employment Office

The employment office is the place where men get their first impressions of company policies. It was felt that this was the logical place to begin selling the value of safety. An application for employment is made out by the new man. This covers education, previous experience, and the names of three former employers. In addition, he is questioned regarding any former injuries which he might have received in the past, and in case of former injury, details are requested. This information is felt necessary for company's protection. It also serves to impress the new man with the fact that the company is interested in his past safety record. If the application is accepted, the other details of employment are completed. At this time a short safety talk is made by the safety engineer covering the following points.

1. Bad accidents and the physical and financial suffering of the injured party:

(It has been found that men are nearly always interested in the details of a gruesome accident. If possible, an example is taken from the line of work similar to the man's new occupation.)

2. The company's attitude on careless work:

(Care is used in handling this subject, so that good men will not get the impression that they will be discharged for trivial matters.)

3. The foreman's practice of issuing careful instructions regarding the work to be done:

(The new man is cautioned to listen carefully to his foreman's instructions, and in case he fails to understand them fully, to ask for a second explanation. Men are requested to listen to the advice of the old employees, who may make a suggestion with the interest of the new man in mind.)

If it is impossible to make the talk at the employment office, the safety engineer hunts up the new man on the job, where the same ideas are taken up.

It is felt that new men should leave the employment office with two ideas firmly fixed in their minds, as noted:

1. The company is only interested in careful work and has nothing to offer careless men.
2. Ample safety instructions are provided by the company through the individual foremen in charge.

The new man is now ready for his medical examination.

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*A paper read before the Cement Section of the Fifth Pacific Coast Safety Congress, October 26, 1927.

Medical Examination

Each applicant must pass a satisfactory medical examination before he can start work. These examinations eliminate those physically unfit, detect conditions which would seriously impair men's health if allowed to continue unchecked, and impresses men with the idea that sound bodies as well as general good health are requisites demanded by the company.

It is the writer's opinion that when men realize the necessity for keeping physically fit, more attention will be given to working safely. The new men, having passed satisfactory examinations, are ready to report to their respective foremen.

The Foreman

The new man is assigned to his work by the foreman from whom he secures his instructions covering details of the work. New men are closely watched during the first few shifts, and their mistakes corrected before serious trouble occurs. Another method, often used, is to place a new man under an old operator from whom the new employee receives added instruction. This latter method offers an excellent opportunity for new men to become accustomed to conditions before responsibility is assumed.

In the various departments are members of the Workman's Safety Committee who have been selected by the foreman to represent his department. These committee men often have an opportunity to call the new man's attention to safety precautions, which have been overlooked by him. This advice is generally accepted in the proper spirit, but occasionally a man is found who resents such suggestions. As these misunderstandings rarely occur, the members of the committee feel that their efforts are appreciated.

Effective July 1, 1927, the company inaugurated a safety bonus system, in which the new man participates together with his foreman and fellow workmen. The workmen of the plant are divided into five divisions under the bonus system, and each division has charged against it any and all lost time accidents occurring to the men in their groups. A bonus of one per cent of his monthly wage is paid for every man in each division which shows no lost time accidents for the month. This bonus system was established to assist in reducing accidents, and is one of the activities carried on by the company to create safety interest.

Safety Meetings

At intervals, safety meetings are conducted by the safety engineer in the various departments. These meetings are attended by both foreman and men. A short safety talk is made by the safety engineer covering safety subjects of general interest. While these discussions cover a wide range of subjects, one of the four retarding factors is used as a basis for each talk. In addition, two safety points are always mentioned, namely,—the need for close co-operation between foreman and workmen and benefits resulting from careful work. In presenting the different subjects, all available safety data is used, for it has been noted that the men are always interested in the safety work of other industries.

A foremen's luncheon is held at intervals which is followed by discussions covering foremanship and plant safety. These luncheons are both interesting and instructive, for here ideas are exchanged which indirectly affect every employee. By promoting such activities, the company expresses its appreciation of the sincere work done by the foreman to promote safety, welfare, and production.

Conclusions

When the records of 1927 are compared with the records of 1926, both accident frequency rates and severity rates show an improvement of approximately fifty per cent. In figuring these rates no attempt has been made to classify lost time accidents into groups separating new men from old employees. Segregation is difficult, due to the variation of time which is required to train new men into safe and skilled workmen. Therefore, the improvement noted above for all employees is accepted as representing the improvement among new men also. While these figures are encouraging, it is hoped that more progress will be made as the organization becomes more efficient in training men to work safely.

Midwest Shippers' Advisory Board Annual Meeting Held

The fourth annual meeting of the Mid-West Shippers' Advisory Board was held in Chicago, Illinois, on January 12th, at the Palmer House. The meeting opened with a noon luncheon.

The broad object of the gathering was the estimating of the probable volume of business in the next three months of all important lines of industry and agriculture in the territory. A brief discussion on the subject was presented by B. F. Affleck, president of Universal Portland Cement Company.

Others who addressed the group were: V. L. Alward, president of the American Furniture Mart; C. B. Hazlewood, vice-president of the Union Trust Company of Chicago; A. E. McKinstrey, vice-president of the International Harvester Company; G. W. Reed, vice-president of the Peabody Coal Company, C. R. Robinson, vice-president of the Inland Steel Company, and S. H. Thompson, president of the American Farm Bureau Federation.

In addition to these and other business reports, M. J. Gormley of Washington, D. C., chairman of the car service division of the American Railway Association, reported upon the general transportation situation throughout the country, while W. D. Beck, Chicago district manager of the car service division, summarized midwest transportation conditions.

Indian Cement Manufacturers Meet Foreign Prices

Constant pressure is being brought to bear upon the Indian government to utilize local products, and this is illustrated by a recent debate in the Madras legislature arising out of a resolution in favor of purchasing the whole of the 150,000 tons of cement required for the Metur irrigation project from Indian manufacturers. The capacity of Indian cement works is in excess of Indian consumption, but a price agreement is in operation designed to avert excessive competition for local business, and the Madras legislators have therefore decided that it would not be in the interests of the local taxpayer to restrict tenders to Indian firms.

Accordingly, imported cement will not be excluded from consideration, although keenly competitive prices will be necessary to secure the contract.

The recently opened Gang canal is said to be the longest concrete-lined channel in the world and on the strength of the economic advantages of lining the canals being planned, the Indian Concrete Association is basing its claim that there is a new opening for cement in India.

Rotary Kilns

Heat Balance in Rotary Kilns and Coolers—Tests—Heat Losses—Loss by Radiation—Loss in Flue Gases—Kiln Feed—Burning Zones—Effect of Atomizing Feed—Fuel Supply—Clinker Coolers

By HAL GUTTERIDGE

Considerable interest has been expressed in the articles on kiln design and kiln practice published in previous issues. The material presented in these articles referred to present-day American practice.

In order that our readers may compare the data in the articles previously published with modern British practice, we are presenting the following extract from a paper recently presented by Hal Gutteridge before the Institution of Mechanical Engineers of Great Britain.

ROTARY kilns are usually about 10 feet in diameter by 250 feet in length, but are sometimes constructed as long as 400 feet. They are made of steel plates from ⅝-inch to 1 inch in thickness with one to two sheets to make up the circumference according to the diameter. The joints are usually of the butt type, with external butt straps slightly thicker than the shell. The longitudinal joints are staggered to give uniform strength. A kiln is supported at two or more points on tires. These tires have not only to support the kiln while in motion, but they must also allow for its longitudinal movement due to expansion. The tires are not rigidly fixed to the shell but are fitted on shoes so that they are free to move around the perimeter of the shell. The shoes, which are somewhat similar to rail chairs, are riveted to the shell. To allow for longitudinal expansion, each tire runs on two large flat faced rollers, the bearings being water-cooled. Thrust rollers are employed to keep the kiln in its proper longitudinal position.

The driving girth-gear takes the form of a spur-gear, generally in two parts which are mounted on tangential spring plates riveted to the shell. As the speed of the kiln is between the limits of ½ to 2 revolutions per minute, suitable reduction-gear is necessary. The upper end of the kiln extends into the "dust chamber," and arrangements have to be made to render the joint between the kiln shell and the dust-chamber wall as air-tight as possible. One method of doing this is to have a large flat ring at right angles to the shell, free to move laterally, and a casing on the dust-chamber wall to fit as closely as possible on each side of this ring. Thus the air can only enter by passing up one side of the ring and down the other, a distance which is often 10 or 12 inches.

The kiln is lined with refractory bricks for about three-quarters of its length from the firing end. Thence to the feed end there is usually inserted a system of curved plates which are designed to cascade the slurry so as to present a greater surface to the gases passing through the kiln. The thickness of the lining generally decreases the further it is from the firing end. In an uninsulated kiln, say of 9 feet diameter and 200 feet long, the thickness of the bricks for the first 80 feet from the firing end would be 9 inches followed by about 15 feet of 6-inch bricks and 60 feet of 4½-inch bricks, the remaining 45 feet being unlined. For a kiln of this size a motor of about 50 b.h.p. would be required.

Heat Balance of the Rotary Kiln and Cooler

Taking a rotary kiln operating on the wet process, the main items are as follows:

(1) Heat necessary to decompose the $CaCO_3$ and $MgCO_3$ in the raw materials.

(2) Heat required to evaporate the water in the slurry.

(3) Heat required to raise steam made from the water from 212 deg. F. to the temperature of the flue gases.

(4) Heat required to heat the flue gases, including excess air, to 212 deg. F.

(5) Heat required to raise these to their temperature at exit.

(6) Heat lost in radiation from the kiln shell.

(7) Heat lost in radiation from the cooler.

(8) Heat lost on account of stoppages.

(9) Heat left in the clinker.

(10) Heat lost due to incomplete combustion.

(11) Heat required to warm the fuel and evaporate any moisture it may contain.

On the other side, which of course must balance the above, are the following:

(1) Heat derived from the combustion of the fuel.

(2) Heat liberated during the formation of the clinker.

(3) Heat due to the temperature of the raw material.

(4) Heat due to the temperature of the fuel.

(5) Heat due to the temperature of the air.

On a six months' test of a rotary kiln operating on the wet process, in 1918, with an average flue gas temperature of 755 deg. F., the flue gas analysis was, CO_2, 23.9 per cent; O_2, 2.48 per cent; CO, a trace; thus showing excess air amounting to 14.75 per cent. The moisture in the slurry was 37.6 per cent and the temperature of the clinker leaving the cooler was 201 deg. F. The fuel used averaged 26.53 per cent of the weight of clinker, when reckoned as "standard" coal, whilst the $CaCO_3$ in the raw materials was 76.1.

The heat required was as follows: (1) 7.83 per cent; (2) and (3) 10.55 per cent; (4) and (5) 4.53 per cent; (6), (7), and (9) 13.36 per cent; (8) 0.26 per cent. Total, 36.53 per cent.

In this test, the flue gas temperature was high, as with gravity feed and slurry lifters it should not exceed 600 deg. F. The 37.6 per cent moisture in the slurry was lower than usual in practice. The excess air could be below 14.75 per cent, and a good gas analysis would show from 2 to 1.5 per cent O_2, no CO and the CO_2 as high as 25 or 26 per cent. This would give a thin white vapor. The temperature of 201 deg. F. of the clinker leaving the cooler was high and could be reduced to about 180 deg. F. To obviate the loss of heat from stoppages the best possible running hours should be maintained. A 5 per cent stoppage allowance would be good over a long period.

Lewis and Radasch,[1] in a very thorough test on a rotary cement kiln 135 feet long and 6 feet 4 inches diameter, give a heat distribution as follows:

	Per Cent
Heat input	100
Heat output—	
Heat of reaction	18.7
Sensible heat in gas	36.7
Potential heat in gas	0.3
Sensible heat in clinker	7.5
Heat required to charge	0.1
Heat to vaporize water in charge	0.3
Heat loss, by difference	36.4
	100.0

The last item of unaccounted heat lost includes heat lost by radiation and convection from the kiln shell and cooler.

Redgrave and Spackman[2] give the following average heat distribution:

	Per Cent
Calcination	20
Radiation	20
Flue gases	40
Clinker	20
	100

In kiln operation the closest attention should be paid to the following points:

(1) Keeping the temperature of the flue gases as low as possible.

(2) Reducing the water in the slurry to the minimum possible.

(3) Reducing the amount of excess air.

(4) Providing the most efficient cooler.

(5) Reducing the heat lost by radiation from the kiln.

(6) Maintaining the best possible running hours.

The perfect kiln on the wet process would need to comply with the following conditions:

(*a*) That the kiln and cooler were perfect heat insulators.

(*b*) That the clinker going out of the cooler was at the same temperature as the slurry going in.

(*c*) That the hot gases passing out of the kiln were no warmer than was absolutely necessary to keep the water in the slurry in the form of steam at 212 deg. F.

(*d*) That the air used for combustion and necessarily raised to 212 deg. F. which would be the back-end temperature of the kiln, was neither more nor less than was required for the perfect combustion of the fuel in the kiln.

(*e*) That the amount of water in the slurry was as low as possible.

(*f*) That there were no solids carried out with the flue gases.

Heat Lost by Radiation

The losses from the kiln shell have within recent years received much attention, as it is recognized that a considerable amount of heat is dissipated in radiation and convection. Meade gives the results of an investigation on an 8-foot diameter by 125-foot rotary kiln burning wet materials which was divided into three zones, each 25 feet long, at the feed end, followed by four zones, each 12½ feet long, at the firing end. The total heat lost per hour was 3,906,640 B.t.u.'s, while the output of clinker during the test was about 3.75 tons per hour. The heat lost per ton was therefore 1,040,000 B.t.u.'s. The calorific value of the coal was 14,000 B.t.u.'s per lb. and the consumption per ton of clinker was 707 lbs. The total quantity of heat supplied by the coal per ton of clinker was 9,900,000, so that the loss by radiation in this case amounted to 10.59 per cent of the heat supplied by the fuel. The percentage loss varies with the conditions; thus it has been found that the radiation loss from a horizontal surface exposed to wind is 30 per cent greater, and of one exposed to wind and rain 70 per cent greater, than when the surface is exposed only to still air.

To decrease the radiation losses from the kiln shell, there are two methods in use. The first is by housing the kiln throughout its length in a building. It is remarkable how often even this is not done, and it is no unusual sight to see kilns in this country quite uncovered and exposed to the elements, with a consequent large and unnecessary waste of heat. The second method is by the insertion of heat-resisting blocks between the refractory lining and the shell. This has been successfully and widely done in America and in other countries. Care has to be taken with the fitting and jointing of both the blocks and bricks. At the firing end for the last 25 feet or so the heat-resisting blocks are discontinued as it has been found in practice that the great heat in this zone attacks the jointing and there is a danger of collapse.

In a test on a rotary cement kiln, C. R. Darling[3] gives the following particulars: "The external surface varied in temperature from 400 deg. F. at the hottest part to 150 deg. F. at the entrance to the flue, the average being 280 deg. F. The heat loss per square foot per hour was therefore 610 B.t.u.'s, and as the area of the exposed surface was 2,830 square feet, the total escape per hour was 1,726,300 B.t.u.'s equal in 24 hours to 2½ tons of the coal used. The heat escaping in 300 working days would therefore represent a loss of 750 tons of coal." The output of the kiln is not stated, but if it be taken that 630 square feet of external surface is required per ton of clinker produced per hour, the output would be 4.5 tons per hour. With a coal consumption of 650 lbs. per ton of clinker, the loss expressed as a percentage of the total coal used would be 8 per cent, or 6*d*. per ton of clinker produced with coal costing 20*s*. per ton.

If, by the insertion of insulating blocks behind the firebrick lining, the external surface temperature were reduced to say an average of 180 deg. F., then by the Darling curve 300 B.t.u.'s would escape per square foot per hour, or the loss would be approximately half that occurring when the average temperature was 280 deg. F. Meade states that the insertion of a 3-inch layer of insulation blocks probably reduces the radiation losses to from 25 to 50 per cent of what they would be without it. Brobston[4] found that when a brick cut from diatomaceous earth was placed between the shell and the firebrick lining in the upper part of the kiln in a plant where waste-heat boilers were used, the insulation raised the temperature of the flue gases 150 deg. F. and where waste-heat boilers were not installed the insulated kilns required 30 to 60 lbs. less coal per ton of clinker. He adds that insulating bricks cannot be used in the burning zone as they are destroyed in from sixteen hours to four days, but that this zone could be insulated with carborundum were the cost not prohibitive. It is not practicable to lag the kiln shell on the outside for if this were done the kiln shell could not be inspected for signs of overheating, showing that the lining has become too thin, that rivets have become loose or that cracks or bulges have occurred in the shell.

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[1] "Industrial Stoichiometry," by W. K. Lewis and A. H. Radasch, New York, 1926, pages 95 *et. seq.*

[2] "Calcareous Cements," by G. R. Redgrave and C. Spackman, 1924.

[3] *Engineering*, 1913, vol. 96, page 643.

[4] *Mechanical Engineering*, 1922, vol. 44, pages 517-518.

Loss in Flue Gases

Another large loss of heat occurs in the flue gases. This is in the neighborhood of 42 per cent of the heat of the coal burned. Arnold[5] states that approximately 45 per cent of the total heat in the coal, as fired in insulated kilns, is delivered to waste-heat boilers by the flue gases.

In some other countries waste-heat boiler installations are used to recover part of this heat and to turn it into useful work, but in this country it is not the practice. According to H. A. Schaffer,[6] of the Portland Cement Association, only eight cement mills in America had waste-heat boilers in 1919, but in 1924 thirty-five waste-heat plants had been installed and a further eight were under construction. The loss of heat due to the temperature of the discharged clinker will be discussed later under the heading of "coolers."

Kiln Feed

It is in connection with the reduction of heat losses in the flue gases that the "atomizing" method of feeding the slurry into the kiln is of particular interest. Instead of pouring the slurry into the kiln through a pipe placed nearly vertically, it is forced under pressure through spraying nozzles into the feed end of the kiln. There are generally two or three nozzles, which are capable of being set at different angles and the slurry pressure can also be altered, so that the maximum amount of dispersion is obtained and the greatest surface area is exposed to the flue gases passing through the sprays. The great advantage in principle lies in the increase of surface exposed to the flue gases as compared with the surface exposed with the gravity feed, and the consequent greater rate of heat transference from the flue gases to the slurry.

During the passage of the raw materials through the kiln various changes take place which may be divided roughly into five zones, starting at the feed end.

First Zone—In this zone, in the wet process, the slurry enters the kiln at about 12 deg. C. (53.6 deg. F.), the water is evaporated, and the material is raised in temperature. In the dry process, only the dry materials have to be raised in temperature. In this zone various secondary reactions occur, such as the liberation of the combined water in the raw materials, and the burning of the sulphur and organic matter.

Second Zone—In this zone, the dried raw materials are heated to a temperature at which the calcium carbonates commence to decompose. This occurs in a comparatively short distance as the temperature rises very rapidly. This zone is termed the "heating" zone.

Third Zone—This zone is called the "calcining" zone, where the CO_2 is gradually given off, the process being complete when the temperature reaches 1,100 deg. C.[7]. The giving up of CO_2 results in a marked reduction of the weight of the material.

Fourth Zone—In this zone, named the "sintering" or "clinkering" zone, the lime, alumina and silica unite at between 1,100 deg. C. and 1,500 deg. C.[8] to produce the mixture of calcium silicates and aluminates which comprises portland cement clinker. An exothermic reaction takes place adding to the heat in the kiln.

Fifth Zone—This zone is termed the "firing" zone, where the temperature declines as it meets the warmed air necessary for combustion coming from the cooler or other source.

Effect of Atomizing Feed

By the introduction of the atomizing feed system, according to a description given in *Engineering* (1926, vol. 121, page 681), the effect of the spray feed is that the drying and heating zones are considerably shortened, as instead of 57 per cent of the length of the kiln, only about 40 per cent is required, with the result that, as the sintering and firing zones are of the same length in both systems, the calcining zone is increased from about 30 to 47 per cent. A greater output of clinker is claimed as a result of the longer calcining zone with the same length of kiln, or a reduction of fuel for the same output. Conversely, the length of the kiln could be shortened without decreasing the output. In the article referred to, it is stated that a kiln 206 feet long could be reduced to 166 feet by adopting the atomizing method, without reducing the output. Also that the life of the kiln lining appears to be somewhat prolonged owing to the absence of slurry rings and the smaller size of the clinker tends towards lower grinding costs.

The lower final temperature of the exit gases from the kiln, which to be with gravity feed is in the neighborhood of 400 deg. C., is stated with atomizing feed, about 150 deg. C. This comparatively low final temperature would dispose of one problem which has always faced the designer of cement plants, that is how to employ economically the large amount of heat that, with the gravity feed, passes to waste up the chimney. Waste-heat boilers to generate steam for the power supply require a temperature at the inlet to the boiler of about 600 deg. C. (1,112 deg. F.) in the wet process and 700 deg. C. (1,300 deg. F.) in the dry process. With a temperature in the neighborhood of 150 deg. C. (300 deg. F.) the employment of waste-heat boilers, in the form they exist today, is not likely to be economical. This method of feeding the kilns is at the present time in course of development in practice, and its progress will be watched with interest.

Fuel Supply to Kilns; Pulverized Coal

The coal, before it is in a suitable condition for burning in a kiln, has to go through a series of treatments. As received, it will have a moisture content of from 8 to 15 per cent; it will be in sizes from fine dust to lumps of 2 inches or more, and it will sometimes be mixed with pieces of metal in the form of iron spikes, etc. It must be prepared so that, at its entry into the kiln, it will be in such a state of fineness that the residue on a 100 x 100 standard screen (10,000 meshes per square inch) after 15 minutes' continuous shaking, will not exceed 5 per cent, and on a 180 x 180 standard screen (32,400 meshes per square inch) will not exceed 15 per cent.

The older method of carrying out this series of treatments was to do them separately; the coal was crushed and dried, metallic substances were separated, it was pulverized, stored and blown into the kiln, each by a separate unit. This method necessitated a considerable amount of plant, capital outlay and heavy running costs.

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[5] *Power*, 1926, vol. 64, page 232.

[6] *Power*, 1924, vol. 59, page 150.

[7] Otto Dorman, "Neue Gesichtspunkte zur Beurteilung des Kohlenverbrauchs in Zementdrehrohrofen," *Ton-Industrie Zeitung*, 1914, vol. 38, page 1,741.

[8] William Poole on "Limes and Cements," Trans. Inst. of Engineers, Australia, 1924, vol. v, page 101.

In the later method, all of the treatments are performed by a coal pulverizer generally preceded by a coal drier. The pulverizer is placed directly behind the kiln to be served and is on a level with the firing platform. It is usually placed on its own separate foundation so that any vibration will not be communicated to the platform. The unit machine, therefore, receives the coal, separates all metallic or other heavier-than-coal substances, pulverizes it, and finally delivers it direct into the kiln. Hot air from the clinker cooler at a temperature of about 400 deg. F. is drawn into the machine and comes into contact with the coal during pulverization, and as a result raises its temperature. A rejector is also arranged so that all particles above a certain size are returned to the machine for further treatment. The power required is about 14 to 15 kw.-hrs. per ton of coal pulverized.

In one type of pulverizer shown in Fig. 1, the coal from the hopper A descends onto a variable feeder and then falls down a passage in the body of the pulverizer to the metal separator B. Here the coal is met by an air current, the velocity of which carries it into the pulverizing chamber C, but allows the metal and stone to fall to the base of the machine. The rotor D divides the chamber into two parts. On the inlet side there is a number of hammers E freely pivoted to the hub. When in action, these are held out by centrifugal force and beat the coal through the screen F whence it is carried by the air stream to the second stage. Here the fine pulverizing is carried out, the elements consisting of alternate rows of moving and fixed pegs G and H. The hot air for drying the coal enters through the passage J. The rejector K separates the coal that has not been sufficiently pulverized and returns it to the machine. The end casing contains a fan L, which blows the pulverized coal and air direct to the burners.

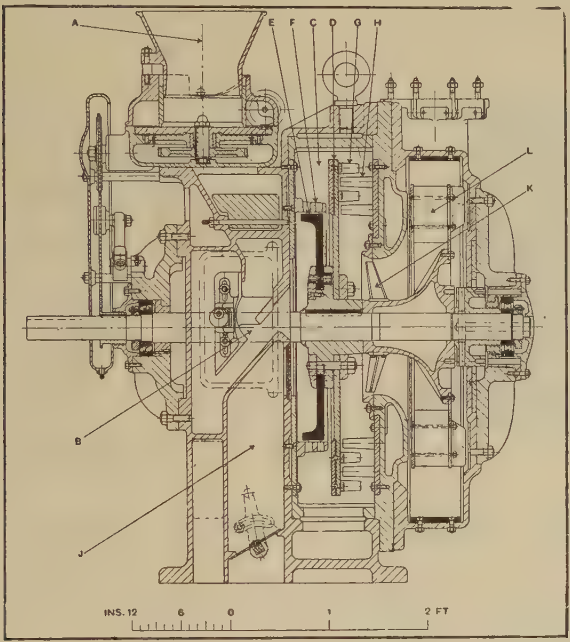


Figure I

Clinker Coolers

The size of the usual type of rotary cooler depends on its complementary unit, the kiln, and ranges from 5 feet diameter by 50 feet long to 8 feet diameter by 80 feet long, the horsepower necessary being about 10 to 15 respectively. There are two alternative positions for the cooler with respect to the kiln; either the cooler is set on a continuation of the same axis as the kiln, or it is doubled back underneath it. In either case the hot clinker at about 1,148 deg. C. (2,100 deg. F.) falls by gravity into the cooler through the movable kiln-hood; it is cascaded inside the cooler and delivered to the clinker conveyor. Each kiln is provided with a cooler so that the whole represents one unit.

Cooler Lining

The cooler is lined in various ways partly with fire-brick and partly with lifting plates, depending on individual design. At the delivery end it is sometimes perforated for the last three or four feet to act as a rotary screen, the lumps unable to pass through the 1½-inch to 2-inch holes being discharged over the end to a separate heap. Alternatively, the discharge end of the cooler has lifting plates so that the clinker is discharged at or near the top of the discharge end, thereby saving 4 or 5 feet of height.

The heat content of each ton of clinker at 2,032 deg. F. is (2,032 — 32) × 2,240 × 0.246 = 1,100,000 B.t.u.'s, equivalent to the heat value of about 92 lbs. of coal of 12,000 B.t.u.'s per lb., and if it is assumed that each ton of clinker requires about 650 lbs. of coal, this represents about 14 per cent of the whole. If the cooler had a thermal efficiency of 100 per cent, this large amount of heat would be transferred to the air passing through the cooler on its way to the kiln, but losses take place due to the heat radiated from the cooler shell and to the heat going out in the clinker. The loss of heat by radiation is about 35 per cent of the heat in the clinker entering the cooler, that is, 385,000 B.t.u.'s.

If the temperature of the clinker leaving the cooler is taken at 230 deg. F. and the specific heat at 0.246, the heat contained in each ton of it will be (230 — 32) × 2,240 × 0.246 = 109,000 B.t.u.'s. The combined loss will be 385,000 + 109,000 = 494,000 B.t.u.'s and the remainder, 1,100,00 — 494,000 = 606,000 B.t.u.'s is transferred to the air. This gives a thermal efficiency of 55 per cent, and the saving resulting from the use of a cooler is about 7.7 per cent of the fuel used. H. A. Schaffer states that the recovery of heat from clinker at a temperature of about 2,100 deg. F. by preheating the combustion air results in a saving of 7 to 8 per cent.

Combined Kiln and Cooler

One type of cooler recently introduced in this country is a distinct departure from ordinary practice. It takes the form of a combined kiln and cooler. The kiln follows the usual practice, having at the firing end a portion which is of considerably larger diameter than the kiln tube, and it is in this that the clinker is cooled. The cooler comprises a series of tubes arranged around a central cylinder which is an extension of the kiln tube. It is provided with a thin lining of refractory heat-insulating material and is closed at the end remote from the kiln with a cap or hood of similar design to the firing hoods of ordinary rotary kilns. Kiln and cooler, being rigidly connected, revolve together as a single unit.

In this type a separate cooler is unnecessary, the piers to support the kiln, and consequently the kiln building, can be much lower than is the case with the usual type of kiln and separate cooler. It is claimed that this type of kiln is more efficient thermally than the usual type for the following main reasons: (1) the cooling of the clinker is more efficient, and (2) the loss of heat from the clinker in passing to the cooler is much less. The makers give the result of a works test abroad where a coal consumption of 22 per cent of British standard coal was realized with a slurry containing about 40 per cent of moisture.

New Safety Board of Awards to Reward Workmen Who Help to Prevent Accidents

Safety Board of Awards Formed—Composed of Three Company Presidents—To Give Recognition to Workmen Who Perform Acts of Bravery in Preventing Accidents to Fellow Workers

CEMENT plant heroes—workers who perform conspicuous acts in the avoidance of accidents in plants—will from now on be rewarded in some form or another by the new Safety Board of Awards of the portland cement industry. The presidents of three cement companies and former heads of the Portland Cement Association form the board.

Developments in safety work have aroused the feeling that individual workmen should be given recognition for bravery. The new board has been formed for the specific purpose of recommending appropriate recognition for workers who save human life through the avoidance of mill accidents. Acts of the nature have already been the means of cutting serious mishaps and it is hoped that the work of the Board of Awards will help to make such acts of greater inspiration to other workmen.

Recognition

Each act of an outstanding nature will be reported by the plant superintendent to the secretary of the Committee on Accident Prevention of the Portland Cement Association, who also acts as secretary of the Board of Awards. Each case will be considered individually and a fittng reward decided upon by the personnel of the board.

The members of the board, L. T. Sunderland, B. F. Affleck and F. W. Kelley, are outstanding figures in safety work and were selected because of this fact.

F. W. Kelley is president of the North American Cement Corp., Albany, N. Y., and has been named chairman of the awards committee. Mr. Kelley was president of the association at the time of the celebration of the hundredth anniversary of portland cement and headed the delegation to England whose duty it was to place a tablet at Leeds in honor of Joseph Aspdin, inventor of the product.

B. F. Affleck is president of the Universal Portland Cement Company, Chicago, and was chairman of the committee that had charge of the building of the Portland Cement Association headquarters. L. T. Sunderland heads the Ash Grove Lime and Portland Cement Company, Kansas City, Mo., and has been a constant leader in the advance of safety work both in his own plant and throughout the industry.

While the Safety Board of Awards is rewarding individuals, the Portland Cement Association continues to distribute safety trophies to plants having records for the year. At the end of 1927 it was necessary to ship ten of the 8-ton sculptured monuments. Ten perfect records establishes a new mark in the history of safety work. The end of the year previous, 1926, saw two perfect records, as did also 1925. One plant achieved a clear record in 1924.

Cement mills winning safety awards for 1927 are:

LET'S WIN This Trophy!

READ THESE RULES NOW

1 The Portland Cement Association safety trophy for 1928 will be awarded to each member plant with a perfect safety record during the calendar year. The name of the winning plant and the year in which won will be inscribed on each trophy awarded.

2 In case the contest is won by a plant having previously received the trophy, recognition shall be given by placing an additional inscription on the trophy previously presented, rather than by awarding an additional trophy.

3 Only lost time accidents or those involving death or permanent disability shall be considered in determining a perfect safety record. A lost time accident is defined as one to which the injured loses more than the remainder of the shift or day in the course of which the accident occurred.

4 In determining whether accidents are chargeable to plant, the judges shall be guided by the rulings of the various compensation boards.

Previous Winners

1926 Mitchell, Indiana, Plant No. 2, Lehigh Portland Cement Company and Fort Whyte Plant, Canada Cement Company, Ltd.

1925 Port Colborne Plant, Canada Cement Company, Ltd., and Duluth Plant, Universal Portland Cement Company.

1924 Mitchell, Indiana, Plants, Lehigh Portland Cement Company.

1923 San Antonio Portland Cement Company, San Antonio, Texas.

5 Only plants promptly reporting accidents and making annual reports of man-hours worked shall be eligible to compete.

6 In order to qualify in the competition, plants must be in operation an aggregate of at least six months of the year.

7 The trophy award to winning plant or plants shall be made at the spring meeting of the Portland Cement Association. Formal presentation shall be made to two delegates chosen from the employes of the winning plant or plants and all the expenses of these delegates in attending this meeting shall be paid by the Association as a part of the prize.

8 The trophy shall be placed in a safe and conspicuous place at the winning plant or plants where employes may see it as often as possible.

DURING 1928

WORK SAFELY

Martins Creek, Pa., and Ironton, O., plants of the Alpha Portland Cement Co.; Belleville, Ont., and Hull, Que., plants of the Canada Cement Co.; Bonner Springs, Kans., mill of the Kansas Portland Cement Co.; Cowell, Cal., plant of the Cowell Portland Cement Co.; New Castle, Pa., and Iola, Kans., plants of the Lehigh Portland Cement Co.; San Antonio mill of the San Antonio Portland Cement Co.; and the Duluth, Minn., mill of the Universal Portland Cement Co.

Both the San Antonio plant and the Duluth Universal plant already possess similar trophies, won in 1923 and 1925, respectively.

The accompanying accident chart indicates the effect of accident prevention work in the past three years, and in particular, the June campaigns sponsored in both 1925 and 1927.

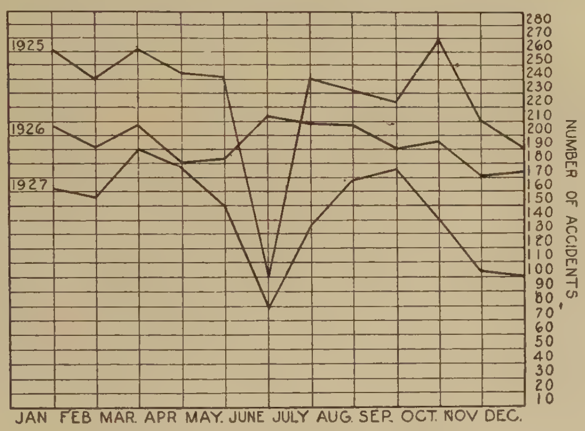
Records Made

During the past year caution and carefulness on the part of workers established the following records:

30 plants operated throughout January, February and March without an accident.

26 plants suffered no accidents during the first six months of 1927.

133 mills operated during the entire month of June without a lost time accident.



THREE YEAR ACCIDENT RECORD

50 plants of the above number had never attained a clear record during any previous month.

17 plants had no accidents in 10 months.

13 plants were without mishaps in 11 months.

10 mills completed the year to win trophies.

All member plants, then in operation, completed the month of September without a fatal accident, the first month without a fatality in the history of the Portland Cement Association.

These plants completed the month of June with but one fatal accident, which established a record for June and for all months up to September.

Thirty-three thousand workers, 2,200 superintendents and 85 company executives signed the June individual pledge cards. Of the 33,000 workmen, 68 became involved in accidents during the month, amounting to about one-fifth of one per cent of the total.

Plans for 1928

No radical changes from the 1927 methods are included in this year's program. Two types of campaign will be used—the competitive and the co-operative. The latter, of which the June activity is an example, will be further developed in that month of this year. Under the plan every man co-operates with his fellow workers. The record depends upon the best efforts of every man in order that his plant may keep the banner on its flag staff.

Month	No. Accidents	Production	Rate Accidents per 100,000 barrels produced
Nineteen Twenty-five			
January	249	8,856,000	2.8
February	232	8,255,000	2.8
March	252	11,034,000	2.29
April	236	13,807,000	1.7
May	234	15,503,000	1.5
June	92	15,387,000	.6
July	231	15,641,000	1.48
August	227	16,419,000	1.38
September	215	15,939,000	1.35
October	259	15,992,000	1.63
November	200	13,656,000	1.47
December	182	10,713,000	1.7
		Average	1.68
Nineteen Twenty-six			
January	197	7,887,000	2.5
February	183	7,731,000	2.4
March	198	10,390,000	1.9
April	171	12,440,000	1.4
May	174	16,510,000	1.05
June	204	16,866,000	1.2
July	199	17,134,000	1.16
August	198	16,995,000	1.17
September	181	16,571,000	1.09
October	187	16,569,000	1.1
November	164	14,193,000	1.16
December	165	10,744,000	1.5
		Average	1.35
Nineteen Twenty-seven			
January	161	8,258,000	1.95
February	147	7,377,000	1.99
March	180	11,452,000	1.6
April	167	14,048,000	1.19
May	142	16,701,000	.85
June	68	17,224,000	.39
July	126	17,408,000	.72
August	159	18,315,000	.87
September	165	17,505,000	.94
October	132	17,174,000	.77
November	96	14,449,000	.67
December	90 (est.)	10,800,000 (est.)	.83
		Average	1.065

Nineteen twenty-eight bulletins and posters, one of which is illustrated, have already been distributed, to secure enlistments under the competitive plan, under which every plant is in direct competition with every other to win the coveted safety award indicating a year of safe operation.

Although 1927 has been a banner safety year, A. J. R. Curtis, Assistant to the General Manager, Portland Cement Association, in charge of accident prevention, has this to say about the cement industry's accident effort: "We have had a good year—but zero is the limit with us; we will not be satisfied until every man in every mill is a safe worker."

Michigan University Has 1928 Fellowships

The University of Michigan, at Ann Arbor, has announced the availability in the next year of several industrial fellowships for graduate students. Applications received before April 1st will be considered.

Cement Statistics for December

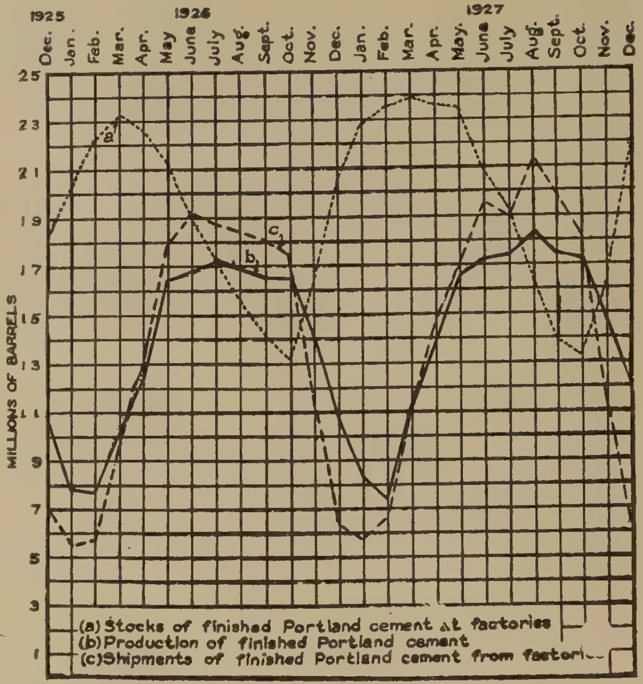
THE portland cement industry in December, 1927, produced 11,999,000 barrels, shipped 6,200,000 barrels from the mills, and had in stock at the end of the month 21,821,000 barrels, according to the United States Bureau of Mines, Department of Commerce. Production of portland cement in December, 1927, showed an increase of nearly 12 per cent and shipments a decrease of nearly 4 per cent, as compared with December, 1926, and portland cement stocks at the mills were nearly 6 per cent higher than at the end of 1926.

The preliminary totals for 1927 show increases of over 4 per cent in production and more than 5 per cent in shipments over the final totals for 1926.

In the following statement of relation of production to capacity, the total output of finished cement is compared with the estimated capacity of 155 plants at the close of December, 1927, and of 141 plants at the close of December, 1926.

Relation of Production to Capacity
(Figures Represent Per Cent)

	—December—		Nov.	Oct.	Sept.
Period	1927	1926	1927	1927	1927
The month	60.7	60.0	75.9	87.4	92.6
The 12 months ended	73.9	76.2	73.7	73.6	72.3



Production, Shipments and Stocks of Finished Portland Cement, by Months and by Districts, 1926 and 1927, and Stocks in November, 1927

	Production		Shipments—December		Stocks at end of month	
	1926	1927	1926	1927	1926	1927
January	7,887,000	8,258,000	5,674,000	5,968,000	20,582,000	22,914,000
February	7,731,000	7,377,000	5,820,000	6,731,000	22,385,000	*23,563,000
March	10,390,000	*11,450,000	9,539,000	*11,100,000	23,236,000	23,922,000
April	12,440,000	14,048,000	12,965,000	14,350,000	22,710,000	23,654,000
May	16,510,000	16,701,000	17,973,000	16,865,000	21,255,000	23,503,000
June	16,866,000	17,224,000	19,134,000	19,761,000	19,000,000	20,972,000
July	17,134,000	17,408,000	18,812,000	18,984,000	17,301,000	19,397,000
August	16,995,000	18,315,000	18,583,000	21,411,000	15,718,000	16,292,000
September	16,571,000	17,505,000	18,087,000	19,828,000	14,188,000	13,996,000
October	16,596,000	17,174,000	17,486,000	18,105,000	13,334,000	13,141,000
November	14,193,000	14,449,000	11,276,000	11,619,000	16,243,000	*16,022,000
December	10,757,000	11,999,000	6,432,000	6,200,000	20,679,000	21,821,000
Preliminary total	164,070,000	171,908,000	161,781,000	170,922,000		
Amount of underestimate	460,000		406,000			
Final total	164,530,000		162,183,000			

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*Revised.

District	Production—December		Shipments—December		Stocks at end of December		Stocks at end of Nov., 1927*
	1926	1927	1926	1927	1926	1927	
Eastern Pennsylvania, New Jersey, Md.	2,875,000	2,941,000	1,582,000	1,671,000	4,081,000	5,034,000	3,765,000
New York	634,000	701,000	233,000	402,000	1,284,000	1,504,000	1,205,000
Ohio, Western Penn., and West Virginia	851,000	970,000	543,000	445,000	2,461,000	2,595,000	2,069,000
Michigan	741,000	952,000	330,000	317,000	1,897,000	2,136,000	1,501,000
Wisconsin, Illinois, Indiana, and Kentucky	1,530,000	1,605,000	632,000	544,000	2,984,000	2,573,000	1,512,000
Virginia, Tenn., Ala., Ga., Fla.,† La.‡	1,022,000	1,162,000	951,000	786,000	1,195,000	1,680,000	1,304,000
Eastern Missouri, Iowa, Minn. and So. Dak.	904,000	1,247,000	284,000	240,000	2,937,000	2,731,000	1,724,000
Western Missouri, Nebraska, Kansas, Okla.	*616,000	713,000	380,000	357,000	1,777,000	1,622,000	1,265,000
Texas	379,000	514,000	316,000	358,000	444,000	407,000	252,000
Colorado, Montana, and Utah	87,000	113,000	69,000	63,000	484,000	365,000	315,000
California	*982,000	902,000	978,000	890,000	667,000	788,000	776,000
Oregon and Washington	*136,000	179,000	134,000	127,000	468,000	386,000	334,000
	10,757,000	11,999,000	6,432,000	6,200,000	20,679,000	21,821,000	16,022,000

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*Revised. †Began producing September and shipping October, 1927. ‡Began producing June and shipping July, 1927.

EDITORIALS

What of 1928?

THE preliminary figures just released by the Bureau of Mines show a healthy growth on the part of the cement industry during 1927.

The production total for 1927 of 171,908,000 barrels is 7,378,000 ahead of the figure for 1926—an increase of about 4½ per cent. The total for shipments in 1927 was 170,922,000 barrels, which is 8,735,000 barrels, or about 5 1/3 per cent, ahead of the shipments for 1926.

Considering these figures in the light of the general activity of the construction field they appear unusually favorable. A particularly pleasant thing to contemplate is the fact that shipment increased nearly 1 per cent more than did production. In other words, a better balance between production and sales was maintained during the past year than during 1926.

This increase in the sale of cement was not due to any general increased construction activity, but was due rather to an increased acceptance of concrete as a structural material. In other words, concrete, to a greater extent than in any other previous year, was used to replace other accepted building materials.

But what of 1928? Will the production and sale of cement again show a comfortable increase? Or will the cement industry share in the slight decline which may possibly overtake general construction during the coming year?

It depends upon the industry, and by that is not meant co-operative promotional activities alone. Excellent as the results from this work have been, it has been demonstrated that under present highly competitive conditions individual manufacturers must keep pace with the co-operative work if they intend to benefit properly from it. Individual companies must continue educational work, must in fact increase their educational work, and continually promote the sale of their product for new uses. In that lies the hope of the industry for continually increasing production during the next few years.

The fact that more individual cement manufacturers are establishing service and promotional departments is an indication that they feel such efforts to be worth while.

Cement production has increased so regularly, and with so little regard for the fluctuations affecting other industries, that many people in the field have come to expect a comfortable growth at the end of each year regardless. But this increase doesn't just happen, it is the result of plenty of hard work. And we are inclined to believe that the point is now being reached where the individual manufacturers must intensify their own sales efforts in order to continue to reap the results of the excellent promotional work that has built up the market in the past.

Farm Uses of Cement

NOT long ago a farmer secured a copy of a booklet telling him how to make various things for use around the farm with cement.

"A good idea," he thought. So he bought some cement from his local dealer and made a watering trough for his horses. It looked fine—for a very short time. Then it went to pieces.

A little while later the subject of a county road improvement program came up. It happened that this man was a member of the County Board and served on the Road Committee. Little wonder that he used his influence against concrete roads. Didn't he know that concrete wouldn't stand up?

A little incident, but it might have been enough to swing the road program to another material than concrete. And it illustrates a point that is worthy of the consideration of cement manufacturers.

Should anybody and everybody be encouraged to build his concrete structures himself? Is it not better for the man who uses the structure, and for the best interests of the cement manufacturer also, to consider the making of concrete a specialty, requiring at least some experience and training?

Of course, an experienced concrete man could have told that particular farmer just what was wrong with his concrete. But the damage had been done. The opinion was formed. He believed that anybody could make good concrete and when he found that he couldn't, he was inclined to think that nobody could.

Every small town and every farming community might be served by a small contractor who could make these farm and home jobs an important part of his business. Through his experience he would know how to avoid such unfortunate failures and the result would be greater faith in concrete.

With few exceptions, farmers are today enjoying a greater degree of prosperity than they have for several years. They are in a position to spend money for improvements. And they will make many of these improvements in concrete.

The farm market is an important one for cement manufacturers. Is it not just as necessary in this market as it is in the structural or road markets to encourage the making of quality concrete? And would not one good means of doing this be by encouraging experienced concretors to enter this field, rather than encouraging the farmer to do the work himself?

MEN and MILLS

Notes from the Field

Peerless and New Egyptian Form One Company

Form Peerless-Egyptian Cement Company; Combined Assets Placed at $10,899,000; Plants to Continue as Formerly

The combining of the Peerless and the New Egyptian Portland Cement Companies, reported to have been under way for several months, has been effected and the result is the Peerless-Egyptian Cement Company, located at Detroit, Michigan. The merger was completed on January 3rd at a meeting of a committee representing each firm.

Of the gross assets of $10,899,000 listed by the two companies, the Peerless company furnished $7,099,000 and the New Egyptian company $3,800,000. The company will have a net working capital of $1,756,086. Total combined earnings of the two companies for the first ten months of 1927 amounted to $430,946.70.

Newly elected officers of the firm are William Hatch, president; Maynard D. Smith, vice-president; John Gillespie, secretary-treasurer, and Albert Gelalty, assistant secretary and assistant treasurer.

C. C. Peck, vice-president and cashier of the United States Savings Bank, of Port Huron, Michigan, was named chairman of the board of directors. The board is composed of the officers, Mr. Peck and the following: C. R. Bitting, Detroit, S. R. Livingstone and R. D. Baker, Detroit, and A. J. Hennings, Chicago, vice-president of Peabody, Houghteling Company, investment bankers.

The former Peerless company is said to be one of the oldest cement companies in Michigan and in the United States. It was formed from a smaller concern which owned a plant near Alpena. About four years ago Peerless built a large, modern plant in Detroit.

The former New Egyptian company is a reorganization of a smaller concern which owned a cement plant at Fenton, Mich. Less than six years ago, headed by Maynard Smith, it took over the Grand Trunk property in the North End, rebuilt and remodeled it into a modern cement mill and two years ago added a second kiln, doubling its original capacity.

Newago Makes New Production Record; Issues Bonus

The Newaygo Portland Cement Company plant at Newaygo, Michigan, broke its own record of production during 1927, when it produced 4075 cars of cement. This exceeded 1925, the bumper year, by about 60,000 barrels.

Subsequently a bonus wage dividend of 8 per cent to employes was issued.

Lehigh Plant for Cleveland Reported

Reports state that the Lehigh Portland Cement Company, Allentown, Pennsylvania, is planning to build a $1,000,000 plant on the east bank of the Cuyahoga River at Cleveland, Ohio.

The fact became known recently when an ordinance was introduced into the Cleveland city council providing for the vacation of a street at the request of the Lehigh Company.

Windsor Cement Company Sold by United States Gypsum

The Windsor Cement Company, Boston, Mass., has been sold by the United States Gypsum Company to M. T. Ryan of Boston, who purchased the capital stock. The business will be continued under its present name.

The Windsor Cement Company was acquired by its former owners as the result of the purchase of J. B. King & Company in 1921.

Atlas Employe of 32 Years Dies

Harry LeVan of Catasauqua, Pennsylvania, died December 27th at his home. Mr. LeVan joined the Atlas Portland Cement Company at Northampton when its first mill was being erected there thirty-two years ago. He had been employed by Atlas steadily since that time. He assisted in the erection of Mill No. 2 and later in the construction of other plants.

Disputed Value of Plant Settled; Placed at $1,350,000

The value of the properties and business of the United States Portland Cement Company plant at Concrete, Colorado, has been placed at $1,350,000 in the report of an appraisal made in accordance with court decree and filed in the United States district court recently by Ford, Bacon and Davis, New York engineers. The property is expected to be sold in the near future, according to the United States district attorney.

The property was ordered sold by the federal court in December, 1924. Government attorneys and representatives of the company were unable to agree on the value of the plant and the appraisal was ordered in June, 1927.

The normal productive capacity of the plant was fixed at about 700,000 barrels annually.

Lawrence President Elected to Insurance Chairmanship

Frank H. Smith, president of the Lawrence Cement Company, was recently elected chairman of the board of the North American Title Guaranty Company and of the North American Security Corporation.

New Equipment at North American Plant

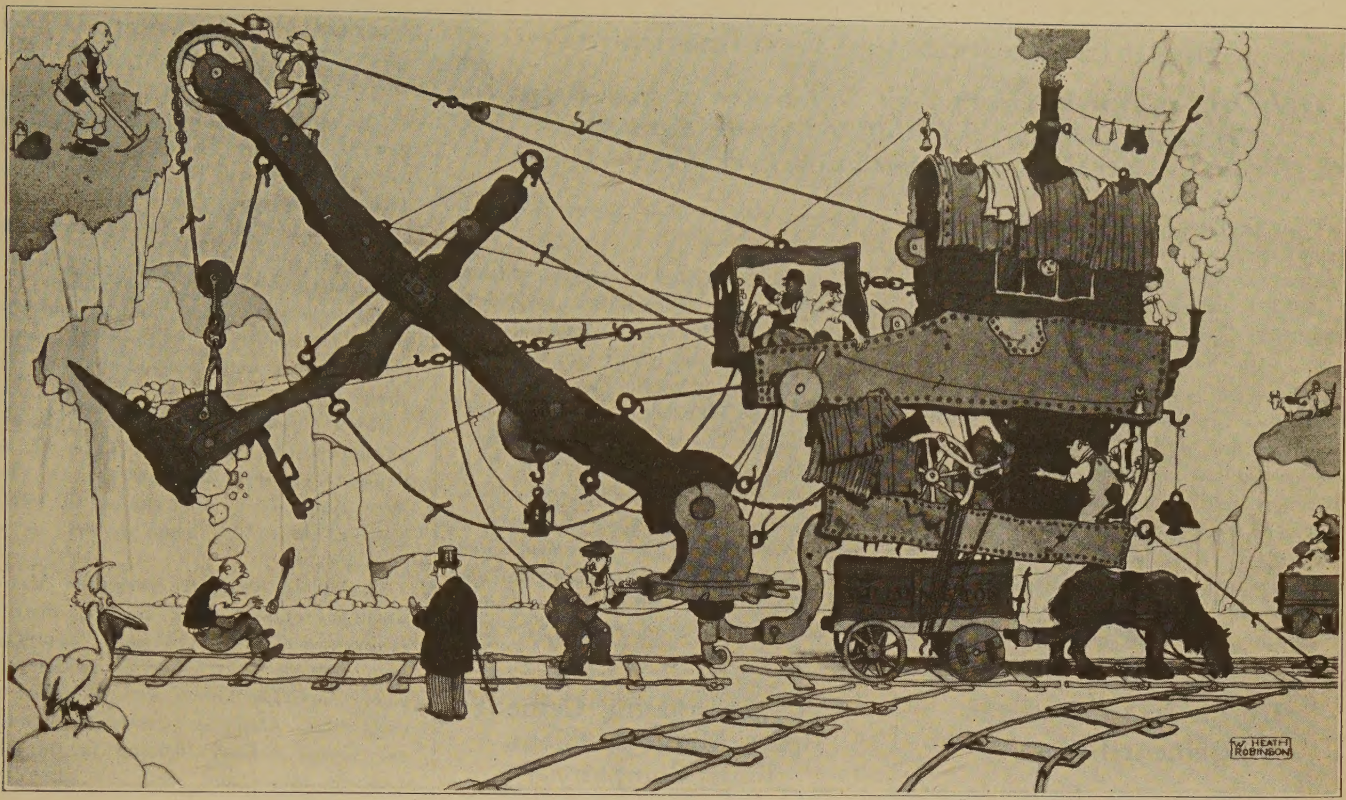
The North American Cement Corporation has about completed the installation of its new power plant and three waste heat boilers. The motors are from 10 to 300 h. p. each.

J. E. Zahn Honored

J. E. Zahn, secretary of the United States Portland Cement Company will go to Honolulu as a representative of the Denver Chamber of Commerce, to attend the meeting of the United States Chamber of Commerce which is to be held in Honolulu during February.

Pacific Dividend

The Pacific Portland Cement Company, San Francisco, Calif., has declared a regular quarterly dividend of $1.62½ a share on preferred stock, payable January 5th.



Gentlemen, this is the process of quarrying in the great modern industry of cement making. In the foreground we see the efficient, $100,000 *steam shovel in operation. The rock that is quarried is known as raw material and is transported by car, as you see in the right background, to the plant, where it is burned and ground.*

This is another of the series of cartoons by a G. & T. Earle, Ltd., England, artist depicting "the Wonders of Wilmington."

Giant Portland Officers Visit City in Group

About thirty officials and representatives of the Giant Portland Cement Company's office at Philadelphia, visited Richmond, Virginia, on December 6th. A conference, followed by a dinner party, filled the day

Cement Company Invites Folks to Visit New Plant

The Colorado Portland Cement Company, early in January, sent out invitations to representative Coloradoans to be its guests, visiting the new cement plant at Boettcher Colorado, near Fort Collins, January 17. Special motor busses and privately owned automobiles formed a long procession, the line leaving from the Colfax avenue side of the state capitol. Lunch was served at the plant.

Lehigh Plant at Mitchell Again in Operation

The Mitchell, Indiana, plant of the Lehigh Portland Cement Company on Monday, January 9th, was again operating at full speed after a two weeks' shutdown.

It is said that there will be a short closing of the plant again some time in March when new machinery will be installed, to be followed by a long and steady run.

Joins Penn-Dixie Sales Department

Alfred Stanford has joined the New York City sales force of the Penn-Dixie Cement Corporation. He was formerly in the mill traffic department.

Wasson Joins Staff of Peerless-Egyptian Cement Company

J. H. Wasson, until recently field engineer in the Detroit territory for the Portland Cement Association, has joined the newly consolidated Peerless-Egyptian Cement Co. of Detroit as Engineer Representative for that organization. Previous to his experience with the Portland Cement Association, Mr. Wasson was engaged on various types of highway and railroad work, with two years of army service during the World War.

Mr. Wasson is a member of the Detroit Engineering Society, American Society of Civil Engineers and American Concrete Institute.

The new cement merger is that formed by the combination of the Peerless Portland Cement Co. of Detroit and Union City, Mich., and the New Egyptian Portland Cement Co. of Detroit and Port Huron.

"Pete" Ridge to Represent Dragon Super Cement in East

R. S. Ridge has been appointed by the Lawrence Cement Company of New York to introduce Dragon Super Cement to the trade in the Philadelphia district.

Mr. Ridge comes to his new work with a wealth of experience in concrete work and with the added advantage of a wide acquaintance among engineers, architects and contractors in the territory he is to serve.

For three years, Mr. Ridge represented the Portland Cement Association in the Philadelphia district as engineer in charge of structural concrete and products promotion. He then organized the Stucco Products Company of Philadelphia and for two years devoted his time to introducing the use of California Stucco in the vicinity of Philadelphia, leaving this work to undertake his present activities.

Petoskey Plant Manager Delegate to G. O. P. Convention

John L. A. Galster, manager and treasurer of the Petoskey Portland Cement Company and former mayor of Petoskey, Michigan, will be a candidate for one of the two district delegates from his district to the Republican national convention meeting next June at Kansas City.

Begin Erection Soon of Carolina Plant

Only Mill in North Carolina To Be Located at New Bern; to Have Capacity of 1,500,000 Barrels Annually; Excellent Transportation Facilities

The Carolina Cement Company, organized some months ago, has completed its plans and will soon begin erection of a 1,500,000 barrel cement plant to cost $3,000,000 and located a mile south of New Bern, North Carolina.

The plant is expected to be ready for operation by September. Two units will be used first, with buildings sufficient to house two later additional units. Adequate highway, water and railway transportation facilities are adjacent to the site. All materials to be used in manufacture, except coal and gypsum, are available locally.

The executives of the Carolina Cement Company are J. A. Acker, president; F. R. Patterson, vice-president, and R. O. Clark, secretary-treasurer.

Coincidentally comes announcement from the state corporation commission of North Carolina regarding a substantial reduction in rates on cement into the state from outside manufacturing points in Pennsylvania, Maryland, Ohio, Indiana, Tennessee, Alabama, Virginia and Georgia, effective from and after April 14, 1928. The announcement followed an Interstate Commerce Commission order covering various complaints in the matter of cement rates from manufacturing plants throughout the territory east of the Mississippi river into the South.

Huron Again Reduces Cement Prices

A further voluntary reduction in the price of "High Grade" Huron, "New Wyandotte" and Ford portland cement, effective January 18, 1928, was announced by the Huron Portland Cement Company, decreasing the market price of portland cement 10 cents per barrel in the Detroit district.

On September 21, 1927, the Huron Portland Cement Company announced a voluntary price reduction throughout Michigan of 15 cents per barrel on "High Grade" Huron, "New Wyandotte" and Ford portland cement.

"That reduction was primarily made to stimulate and promote increasing fall and winter building, and to extend the use of portland cement in the interest of good business. Its beneficial effect for the purpose intended is now plainly apparent. Constructors are busy through the acquisition of important construction contracts involving large yardage of concrete through increased winter building, unprecedented in Michigan because of decreased costs," announces the company.

Colorado Portland Cement Company Announces New Product

Using a full page in the prosperity edition of the Denver newspapers, January 1st, the Colorado Portland Cement Company announced a new product—Hydro-Plastic Waterproof Portland Cement.

Florida Quarry Manager

Mr. G. L. Hanna has been appointed manager of the Brooksville quarries of the Florida Portland Cement Company.

Quick-Hardening Cement Being Made by Glens Falls Company

After a demonstration in which it was shown that the new product was entirely satisfactory, the Glenns Falls Portland Cement Company has started manufacturing Ironclad Velo cement. The new product, which was originated in Denmark, is being turned out in large quantities at the local plant, although winter is not an especially busy season for cement manufacturers.

The American rights for the product were obtained by George F. Bayle, Sr., president of the company, in a trip abroad last summer. The product was demonstrated to Frederick Stuart Greene, commissioner of public works, and other state officials, all of whom were enthusiastic about its possibilities.

No changes in the equipment of the plant are contemplated, according to Mr. Bayle. The same raw products are used in the making of Ironclad Velo, and the same machinery is still being used. Glens Falls Portland Cement is also being made and its manufacture will be continued.

Great Lakes Corporation Increases Capital Stock

The Great Lakes Portland Cement Corporation, of Indianapolis, Indiana, and Buffalo, New York, late in December filed papers increasing its capital stock to 85,000 shares of no par value.

Northwestern Purchases Electrical Equipment

The Northwestern Portland Cement Company has completed the purchase of electrical equipment valued at $75,000 for its plant at Grotto, Washington.

Lehigh Cement Safety and Welfare Banquet

The second safety and welfare banquet of the employes of the Lehigh Portland Cement Company, Mill R, Sandt's Eddy, was held recently at Ross Common Manor. This affair closed a most successful safety year at this plant and all expressed the hope that the leap year will bring still more successful results. This plant, the infant organization of the Lehigh Company, showed the spirit of co-operation among officials, fellow employes and wives at this affair.

The superintendent, James A. Gish, Jr., introduced the toastmaster, Major H. A. Reninger. Major Reninger gave a very interesting talk on this subject of safety and welfare in the home as well as in the plant.

The safety committee presented Major Reninger and Charles Benner, district safety inspector, with tokens of appreciation. Cement vases made of Lehigh cement, containing flowers, were presented to each guest. Attached to these vases were vari-colored balloons floating in the air over the tables and stencilled with the words "Lehigh."

The safety committee of Sandt's Eddy was congratulated for the success of the affair.

Cement Makers Win Freight Rate Fight

Manufacturers of Northampton district, Pennsylvania, as well as other manufacturers in various cities, on December 13th, won their fight before the Interstate Commerce Commission for reasonable and non-prejudicial rates on cement to southern points east of the Mississippi river.

The manufacturers in and near Easton, intervened in behalf of the rate production petition brought by the Lehigh Portland Cement Company against the Aberdeen & Rockfish Railroad Company.

The commission ordered a rate scale higher than the western cement scale No. 2 but somewhat lower in general than western cement scale No. 3. Reparation also was awarded on shipments from Security, Md., to destinations in the South.

The commission split on its decision, one member concurring only in part, the other dissenting in part.

Three hundred railroads were named defendants. The decision is effective in similar actions brought by the Security Cement and Lime Company, Alpha Portland Cement Company, Tidewater Portland Cement Company.

Nazareth Cement Company Quartet Broadcasts

The Fireside quartet and the male chorus of the Nazareth Cement Company of Nazareth, Pa., broadcast from station WKBG at the Royal Theater, Nazareth, recently.